Activity: **6.1**
Select System Architecture

Responsibility: Project Team

Description: When the system architecture for the software product has not been predetermined by the existing computing environment of the system owner and users, evaluate system architecture alternatives to determine which one has the best, cost-effective solution that satisfies the project requirements.

"Cost effective solution" does not imply the least expensive alternative. The "best, cost effective solution" is the alternative that does the best job of satisfying the project requirements, assures the highest quality software product, and provides for an adequate return on investment in a timeframe that is acceptable to the system owner.

Select the specific hardware, software, data base management system, and communication facilities based on the following types of considerations.

- Departmental or site-specific information architecture guidelines or standards
- Hardware and software that emphasizes simplicity, flexibility, ease of operation and maintenance
- Cost to procure and maintain potential environment
- Backup and recovery procedures
- Selection of a distributed or centralized processing environment
- Communication requirements
- Data configuration

Obtain support from functional area points-of-contact to aid in the architecture evaluation process. Consultations and input may be helpful from system and data base administrators, local area network administrators, operations personnel, system programmers, and telecommunication experts.

The following tasks are involved in selecting a system architecture.

6.1.1 Evaluate System Architecture Alternatives
6.1.2 Recommend System Architecture

Task: **6.1.1**
Evaluate System Architecture Alternatives

Description: Consider system architecture alternatives within the site's information architecture guidelines that enable the project objectives and requirements to be achieved. The selection of a system architecture depends on many factors such as the experience of the project team with each alternative and the availability of reusable components to facilitate the implementation of an alternative.

When investigating alternatives, consider the following issues.

- Those functions or portions of functions that are to be automated and the functions that will be manual. Conduct an examination of *what* the automated portion of the project will encompass.
- The technical solution for the objectives. The determinations of *how* the software product is to be designed; (e.g., online vs. batch, client-server vs. mainframe, Oracle vs. Sybase).
- The system owner's and users' computing environment and the needs created by the technical solution. Consider any hardware and software that must be acquired, including system access software, operating system software, data base management system, and telecommunications facilities.

Procedure: The following procedure provides one approach for evaluating the architecture alternatives.

- Conduct an Analysis of Benefits and Costs to determine the most cost effective alternative. On the benefits side, include the improvements over the current process being used to support the business application. On the costs side, include any degradation from current capabilities along with the rationale for allowing the degradation.
- Create and evaluate a data flow diagram for each alternative.
- Identify how users would interact with the features associated with each alternative (such as the generation of queries and reports).
- Create a list of the risks associated with each alternative and develop a plan for mitigating each risk.

Procedure, continued:

- Compare the performance capabilities of each alternative. How fast will each alternative be able to process the user's work given a particular hardware resource. Performance is usually expressed in terms of throughput, run time, or response time. Five factors that frequently affect performance include:

  - Number of intermediate files in a system (park data between programs)
  - Number of times a given file is passed
  - Number of seeks against a disk file
  - Time spent in calling programs and other system overhead
  - Time taken to execute actual program

- Compare the security and access control features of each alternative. To what extent does the alternative provide security against human errors, machine malfunction, or deliberate mischief. Some common controls include:

  - Check digits on predetermined numbers
  - Batch control totals
  - Creation of journals and audit trails
  - Limited access to files

- Compare the ease with which each alternative allows the system to be modified to meet changing requirements, such as:

  - Fixing errors
  - Changing user needs
  - Mandatory/statutory modifications
  - Enhancements

Work Product: Maintain records on each alternative that is evaluated. Use this information to develop a summary of the system architecture alternatives. The summary will be integrated into the materials presented to the system owner when a system architecture recommendation is made. Place a copy of the records for each alternative and the summary in the Project File.

If an Analysis of Benefits and Costs (ABC) is conducted, prepare a report that describes the process used for the analysis, a summary of the alternatives considered, and the results obtained. The report will be integrated into the materials presented to the system owner when a system architecture recommendation is made. Place a copy of the ABC records and report in the Project File.

References: The following documents provide detailed guidance on conducting an Analysis of Benefits and Costs.

- *Analysis of Benefits and Costs (ABC's) Guideline. Volume 1, A Manager's Guide to Analysis of Benefits and Costs.* U.S. Department of Energy.

- *Analysis of Benefits and Costs (ABC's) Guideline. Volume 2, An Analyst's Handbook for Analysis of Benefits and Costs.* U.S. Department of Energy.

Task: **6.1.2**
Recommend System Architecture

Description: Based on the results of the architecture alternatives evaluation, develop a recommendation for a system architecture that is cost-effective and will facilitate the achievement of the software project requirements. Prepare a presentation for the system owner and users that provides the following types of information to support the recommendation.

- Review the limitations or problems with any current manual or automated system that will be resolved by the software product.
- Present the logical model for the software product. Highlight new functions that would be incorporated.
- For each architecture alternative that was evaluated, present the following information.
  - A description of the alternative.
  - An overall data flow diagram showing how the alternative would be implemented.
  - The way the system would look to the users, in terms of hardware, user interface, reports, and query facilities.
  - The estimated benefits of the alternative.
  - The estimated cost and time to implement the alternative.
  - A statement of the element of risk associated with the alternative.
- Present the recommended alternative and explain why it was selected.

Before the project proceeds, the system owner should make a decision about the system architecture either by formally accepting the project team's recommendation or by directing the team to use a different architecture. Any delay in making this decision could result in a slippage of the project schedule.

Work Product: Document the project team's recommendation for the most cost-effective and viable architecture alternative. Provide a summary of each alternative that was evaluated. Describe the rationale for proposing the recommended architecture. Describe the impact of this alternative on the system owner and users organization(s) and other systems. Include any background information that was relevant to the decision process, such as the Analysis of Benefits and Costs Report.

Present the project team's recommendation for the system architecture to the system owner and users. The recommendation can be delivered as a document or as a presentation. Place a copy of the document or presentation materials in the Project File.

Review Process: Conduct a structured walkthrough to assure that the most cost-effective and viable architecture alternative is being recommended.